

DNA Mixture Interpretation Webcast

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<http://www.nist.gov/oles/forensics/dna-analyst-training-on-mixture-interpretation.cfm>

<http://www.cstl.nist.gov/strbase/mixture.htm>

Mixtures Go to Court

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Testimony

- Why is it hard
 - Mixtures and the related scientific questions can be complicated
 - Court testimony can be challenging in many circumstances



- What makes it easier
 - Understanding your role
 - Scientific knowledge
 - Preparation

Review of Roles: the Prosecutor

- Is a representative of the government having justice as the main interest
- Must prosecute within the bounds of the law
- Ensure that the government's evidence is probative and reliable
- Has a duty to provide to the defense any exculpatory material

ABA Standard 3-3.3 Relations With Expert Witnesses

- A prosecutor who engages an expert for an opinion should respect the independence of the expert and should not seek to dictate the formation of the expert's opinion on the subject.
- To the extent necessary, the prosecutor should explain to the expert his or her role in the trial as an impartial expert called to aid the fact finders and the manner in which the examination of witnesses is conducted.

Review of Roles: the Defense Attorney

- Be a zealous advocate of the client within the bounds of the law
- Insures that the defendant's rights are protected
 - Interpose the defendant's constitutional rights against overreaching by the government
 - Duty to obtain all relevant and material discovery and disclosure of exculpatory information
 - Expose through cross examination the weaknesses of the testimony of government witnesses

Standard 4- 4.4 Relations With Expert Witnesses

- Defense counsel who engages an expert for an opinion should respect the independence of the expert and should not seek to dictate the formation of the expert's opinion on the subject.
- To the extent necessary, defense counsel should explain to the expert his or her role in the trial as an impartial witness called to aid the fact finders and the manner in which the examination of witnesses is conducted.

This means:

- Attorneys have an obligation to facilitate your testimony which will provide, among other things, your unbiased expert opinion.
- You are not on anyone's side or part of the prosecution or defense "team".
- The trial outcome is not your responsibility.

Our Role as Expert Witnesses is Different from that of Other Participants

- The expert witness:
 - **As a neutral participant** - presents objective opinions based on sound **Scientific Principles** correctly applied to question before the court.
 - has special knowledge or skill gained by education, training or experience which is beyond that of an ordinary person in a field applicable to the case before the court
 - is allowed to give opinion evidence based on the expertise of the witness

What is different about testimony related to a mixture? **IT'S HARDER!**

- The results are likely to be more complicated than for a single source profile
- You may need to explain one or more of the following
 - How you *know* a profile is a mixture
 - Why you cannot be certain of the number of contributors
 - How are you able to deduce the profile of a second contributor by assuming the presence of a known person
 - Why is the inclusion not an identification
 - Why are some results inconclusive
 - What is the Combined Probability of Inclusion
 - What is a likelihood ratio
 - What is a threshold: analytical, stochastic
 - What is a major contributor
 - What is an indistinguishable mixture
 - What does “polymorphism” mean

The solution: BE PREPARED!!

- Good preparation is essential for good testimony
- Both:
 - Your preparation
 - Preparation with the attorney who will present your direct testimony



Consider the following question and possible answers:

Question: How do you *know* the profile contains a mixture?

Correct answers:

1. There are more than two alleles per locus
2. Many peak height ratios are $< 50\%$
3. Peak heights at amelogenin indicate a mixture

Do these work as expert witness answers?

or-

Question: Please explain allele drop out?

Answer: Well.....(long pause)

How do you bridge the gap between what you know and what you can say to answer this question that is *understandable* to a juror?



Can you
or explain DNA
mixtures to a
5th grader?

Maybe you can't explain DNA
mixtures to a 5th grader, but you can
explain them to a 10th grader!!

the GAP is bridged by:

*A very careful translation which you can construct, and practice, for **any question** you may be think will be difficult to explain.*

1. Define what is the **minimum** number of concepts that are needed to answer the question
 - Make the list and be ruthless in removing unnecessary information
2. In what order would you present these concepts to make the most sense
 - Order the list
3. What is the simplest translation from how you would explain these concepts to a laboratory colleague to how would you say them to a 10th Grader?
4. Write out the explanation in plain English

Question: Please explain allele drop-out?

Answer: Well.....(long pause)

- Even though our methods are sensitive it is possible to have less DNA obtained from a sample than you really need. When this happens the PCR reaction may, by chance, make fewer copies of one allele at a locus than the other. This results in the signal from one allele being less than the signal from the other allele and sometimes signal from an allele becomes so low that it is not detected. This loss of signal is called allele drop-out.

In summary: construct the following

- What would you say scientifically?
- What parts of the description are *essential* to understanding?
- Eliminate the unnecessary concepts
- Substitute common words for scientific terms
- Practice and practice again! (with a live audience)

Preparation with Attorney

- Discuss case results, statistics, discovery with attorney
- Explain the results and conclusions
- Be sure that the attorney understands what you will and will not be saying about the conclusions
 - Does your testimony fit with what the attorney thought you were going to say?
- Explain limitations of your testimony
 - Your areas of expertise
 - Limitation of the data, report, conclusions

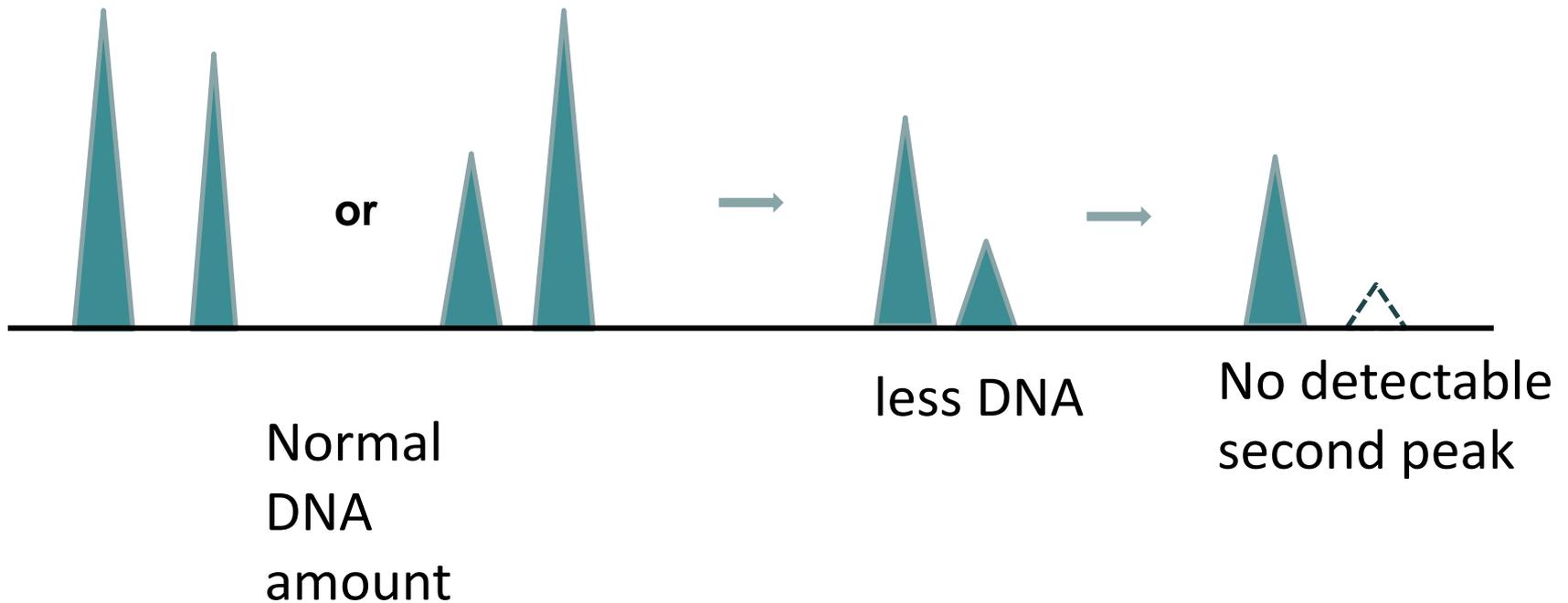
Preparation with Attorney

- Explain all issues and problem areas, related to the case, lab or yourself
 - Typos, strike outs, other small boo boos
 - Any testing irregularities with controls, contamination etc.
- **NO SURPRISES-Attorneys do not like surprises**
- Consider what may be asked in cross exam questions and plan for re-direct

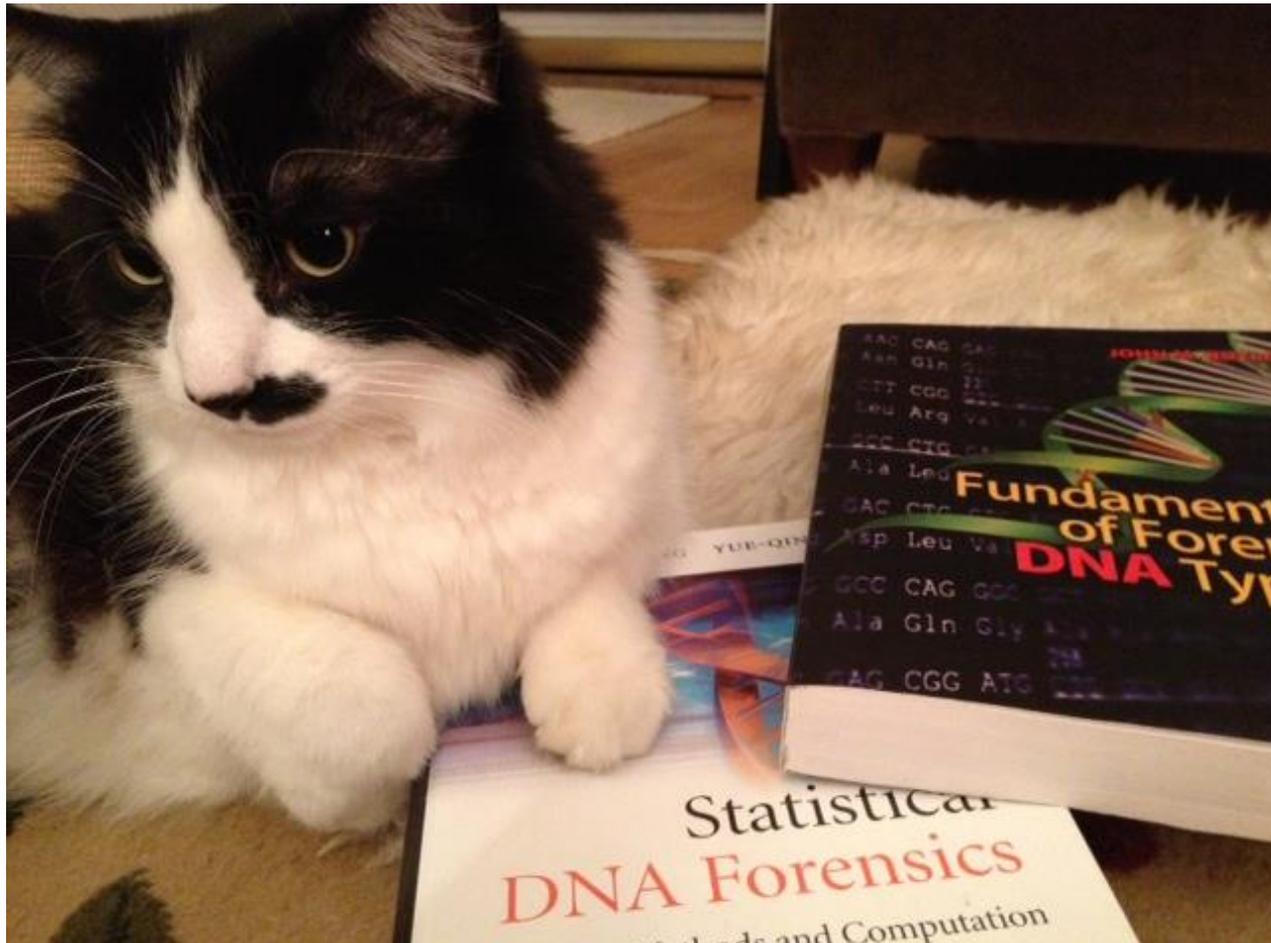
Preparation with Attorney: Materials and Exhibits

- Has the attorney prepared any charts or other visual aids? *(These may be more creative than you anticipated)*
- Is the information on these items accurate?
- Let the attorney know if you need paper and easel. You may want to teach something
- Consider whether drawing a diagram would help with your explanation of drop out?

Would this help the jury to visualize allele drop out?



Your Preparation-Plan a nice outfit and study hard



Your Preparation

- Review case carefully with the goal of deciding: How can the information in case be best presented?
 - Do a complete new technical review
 - Review SOP, validation data or any other documents
 - Outline complicated information
 - Critically review the case data and report(s)
 - What issues do you find?
 - What would you address or challenge if consulting for opposing counsel?

In Court

- Be honest in all answers no matter how difficult or uncomfortable this may be
 - You may be aware that the honest answer assists the case of the opposing attorney
- **Treat all parties with respect all the time**
 - Demeanor and tone is the same regardless of who asks a question
- You are the face of your organization during testimony

Get Comfortable with “Uncertainty”

- There will be some degree of uncertainty in
 - The number and ratio of contributors
 - Whether all alleles are present
 - The genotypes of the contributors
 - The strength of the conclusion
- Explain why it is not possible to know the TRUE answer
 - Admit other possibilities exist and state/quantitate likelihood
 - Exceptions become important when more probable

Use precise language in reports and in testimony-

- Be clear what you know about the number of contributors
 - Validate a properly defined analytical threshold
 - While “two or more contributors” includes the possibility of three or more contributors
 - Be precise and state if the number of alleles indicates “three or more contributors”

Use precise language in reports and in testimony-

- What constitutes a DNA profile
 - One peak
 - Two peaks at one locus
 - Peaks at more than one locus
- If you do not have a complete profile specify how many loci have data or refer to the table
- Do not refer to one peak as “the DNA profile obtained from the bloodstain....”
- If you have results at 6 loci you can say that

Statistics

- Be able to clearly state the question that is being answered with the statistic for the evidence
- Consider other relevant statistics which could be applied using a different method or different assumptions

Statistics

- Focus on the “commonness” or “rareness” of the profile
- Use likelihood ratios
- Clearly state that the numbers presented are “approximate” and the true number would fall in some range around this estimate (based on population samples and Hardy-Weinberg assumptions)



Inconclusive



- Inability/failure to include or exclude
- Why were the results deemed uninterruptable or inconclusive? No DNA or
- Too little DNA
 - **Cannot determine genotypes**
 - Have a partial profile, alleles below stochastic threshold, missing alleles?
 - Too many contributors
 - QC problem, contamination,
 - Cannot do CPI
 - Cannot determine major/minor genotypes

Use precise language in reports and in testimony-especially with inconclusive results

- In weak or inconclusive result where genotypes cannot be unambiguously determined and the best statistical method is use of a likelihood ratio
- Do not use imprecise language such as
 - “His alleles are here
 - “the alleles come back to him”
- These types of statements made by a witness or an attorney are misleading

The need to use non-scientific terms does not mean you can be “loose” when stating results.

- Get out of the witness box and teach when you have to
- Be clear about how much data you have from a sample
- Results at 4 loci are not the same as results at 15
- Everyone can become a better witness

If you hear a Mistake, CORRECT IT!!

- If you realize you misspoke
- Attorney misstates your testimony in any way
- Attorney misstates your conclusion
- Attorney misrepresents the data or meaning of the statistic

You have a new SOP and an old report, what to do?

- Issue an amended report
- Science does not stand still and few people expect it too
- Your knowledge has increased and therefore your opinion has changed
- The new report will reflect the new opinion
- If reports are not affected by SOP changes then no action is needed

Clear Communications: the ethical and professionally responsible forensic scientist...

- Presents accurate and complete data in reports, testimony, publications and oral presentations

Clear Communications: the ethical and professionally responsible forensic scientist...

- Testify to results obtained and conclusions reached only when they have confidence that the opinions are based on good scientific principles and methods. Opinions are to be stated so as to be clear in their meaning. Wording should not be such that inferences may be drawn which are not valid, or that slant the opinion to a particular direction.

Clear Communications: the ethical and professionally responsible forensic scientist...

- Attempt to qualify their responses while testifying when asked a question with the requirement that a simple “yes” or “no” answer be given, if answering “yes” or “no” would be misleading to the jury.

In a recent publication in: Behavioral Sciences and the Law (2010): The Witness Credibility Scale: an Outcome Measure for Expert Witness Research by S.L. Brodsky, et al.

- ❖ These 4 features of the expert witness, taken together, explain approximately 70% of the variance in ratings of the expert from the 264 test participants.

Characteristic	% Variance explained
Confident	50%
Likable	9%
Trustworthy	7%
Knowledgeable	5%

Confidence in yourself and effective testimony comes from:

- What you know
 - Molecular biology, genetics, statistics applied to evaluate or provide weight to the data
 - Scientific literature
 - Validation data
 - Case results and conclusions
- Training and experience
- Your ability to communicate your answers effectively (i.e., in understandable language).

Confidence and effective testimony do *NOT* come from:

- Your SOP
- Your Technical Leader
- Your QA system
- Other lab policy
- Your lab accreditation

- The jury can only see *you*. These other people or entities are not present for them to evaluate.

What is the effect of answering a question by referring to the SOP, technical leader, lab policy, etc.?

- Have you demonstrated true familiarity with the topic?
- Have you demonstrated you know the underlying answer?
- Do you sound well informed?
- The answer is likely to be NO to each of these questions

And finally; In Court

- Honesty is the only absolute requirement
 - Any other thing that goes wrong is repairable

“ The right to search for the truth implies also a duty; one must not conceal any part of what one has recognized to be true.”

Albert Einstein

1879-1953